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FOURTH TAXONOMIC REPORT
ON THE
COPEPODA OF THE SAN DIEGO REGION

BY
CALVIN O. ESTERLY

UNIVERSITY OF CALIFORNIA PRESS
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The copepods described here have been found since the last report was published (Esterly, 1911). With one exception the forms are regarded as new, though some are represented by single specimens. It should be understood, however, that in such cases the descriptions are more or less tentative, since they may need modification if more material is obtained; there is no intention of stating more than is known at present, that is, that the one animal differs from those which represent other species to such a degree that the formation of a new species is advisable. Experience has shown that additional material confirms the conclusion as to specific rank based on a single specimen, and it is unlikely that we are dealing in any of these cases with an individual variation that is without specific value.

The descriptions given are brief, and the figures do not cover all parts, but it is believed that they provide for the recognition of the forms discussed. The hauls in which the animals were found are given by number, and the complete data for the hauls will be found in a publication of the Scripps Institution now in course of preparation.

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Gaetanus ascendens n. sp.

Pl. 10, figs. 1, 3, 6; pl. 11, fig. 39; pl. 12, fig. 56

Adult female. The cephalic spine is short and directed downward, and the rostrum is rather prominent for this genus (pl. 10, fig. 6). The spines on the last segment of the thorax are heavy and pointed toward the dorsal surface of the animal (pl. 10, figs. 1, 3). The proportions of the abdominal segments may be seen in plate 10, figures 1 and 3. The anterior antennae are a little longer than the cephalothorax. The first joint of the posterior maxilliped has the characteristic lamella of the shape and size indicated in plate 11, figure 39. The first foot has specific characters (so far as the forms of this region are concerned; pl. 12, fig. 56), and the first basal of the fourth foot has the row of hair-like spines.

Length: 3.7 mm. (cephalothorax, 3 mm.).

Coloration: Unpigmented and rather opaque in formalin.

Occurrence: Haul 1524.

Euchaeta elongata n. sp.

Pl. 10, figs. 5, 16, 27; pl. 11, fig. 37; pl. 12, fig. 49

Adult female. The head and rostrum in profile (pl. 10, fig. 16) have a characteristic shape; the rostrum is heavy and straight, pointing obliquely down; the frontal hairs are not situated on a noticeable papilla. The sides of the last thoracic segment are not broadly rounded, but end in blunt projection (pl. 10, figs.

5, 27). The genital segment has a characteristic form (pl. 10, figs. 5, 27); it is not symmetrical; the ventral surface is markedly protuberant, with a lamella at the right of the orifice. The figures give a better idea of the form of the segment than is possible in a description.

The anterior antennae are slightly longer than the cephalothorax. In the second foot, the outer marginal spine on the end of the second joint of the outer ramus reaches nearly to the tip of the first spine of the last joint; the middle spine of the third joint is long and extends to the distal margin of the joint, but the proximal and distal spines are short (pl. 11, fig. 37). The outer ramus of the first two (pl. 12, fig. 49) is 2-jointed, though there is some indication of the suture between the first and second joints; the outer margin of the proximal division of the ramus is deeply concave and bears one spine, which reaches to the end of the distal division.

Length: 4.13 mm. (cephalothorax 2.95 mm.).

Coloration: Translucent and whitish in formalin.

Occurrence: Haul 2258.

Onchocalanus latus Esterly

Pl. 10, figs. 13, 15; pl. 12, fig. 58

Drawings are given here to supplement those previously shown (see Esterly, 1911, p. 326). It is certain that this species does not possess a fifth pair of feet, though I stated in the passage just cited that it was lost through mutilation; the specimen described as *O. latus* meet the description of *Onchocalanus* as given by Sars (1905a, p. 18) and by Farran (1906, p. 49) in important requirements notwithstanding the absence of the fifth pair of feet.

The animal figured in this paper was 4.3 mm. in length and was taken in haul 2134.

Scolecithrix aculeata n. sp.

Pl. 10, figs. 2, 25; pl. 12, figs. 63, 64

Adult female. The head is rounded and further characterized by the bifid rostrum, each prong of which is heavy at the base and carries a delicate but stiff and sharp spine at the distal end

(pl. 10, fig. 25). The last segment of the thorax is rounded at the sides and the dorsal margin of the segment is slightly concave (pl. 10, fig. 2). The abdomen is 4-segmented; the genital segment is nearly as long as the second, third, and fourth together; the fourth segment is short, about one-tenth the length of the first segment (pl. 10, fig. 2).

The anterior maxilliped has four pencillate sensory appendages; the others are vermiform. The outer ramus of the first foot is shown in plate 12, figure 64. The fifth foot is 3-jointed; the distal margins of the first two joints have rows or groups of fine spines; the third joint carries a long heavy spine on the inner margin and a shorter one on the distal end, both set with small teeth or spines (pl. 12, fig. 63).

Length: 1.8 mm. (cephalothorax 1.35 mm.).

Coloration: Translucent in formalin.

Occurrence: Haul 2567.

Scolecithrix obscura n. sp.

Pl. 10, figs. 18, 21; pl. 11, fig. 35; pl. 12, figs. 53, 57

Adult female. The head is smoothly rounded and distinctly crested; the rostral filaments are exceedingly delicate (pl. 10, fig. 21). The last segment of the thorax ends on each side in a minute point which is located on the ventral border (pl. 10, fig. 18). The head is fused with the first thoracic segment. The abdomen is 4-segmented and the segments and furca are of about equal lengths (pl. 10, fig. 18).

The anterior maxilliped, as shown in plate 11, figure 35, bears four vermiform appendages and five with tufts at the end. The first foot has a 3-jointed outer ramus, the second joint bearing a very minute spine at the distal end of the outer margin; the third joint has a heavy and much longer spine in that position (pl. 12, fig. 53). The fifth foot is 3-jointed; the third joint has two large spines (one on the inner margin and one at the end) and two minute spines, of which one is at the end of the joint, the other at about the middle of the outer margin (pl. 12, fig. 57).

Length: 2.5 mm. (cephalothorax 1.95 mm.).

Coloration: Rather opaque and without pigment in formalin.

Occurrence: Haul 2134.

Scolecithrix elephas n. sp.

Pl. 10, figs. 8, 17; pl. 12, figs. 59, 62

Adult female. The species may be easily recognized by the shape of the head in profile (pl. 10, fig. 8); the rostrum is bifid and remarkably long and heavy in the basal two-thirds, with a delicate filament at the end. The drawing in plate 10, figure 17, shows the shape of the last thoracic segment and the proportions of the abdominal segments.

The anterior antennae are 23-jointed and 1.6 mm. long. The outer ramus of the first foot is shown in figure 59 and the fifth foot in figure 62 of plate 12. The third joint of the fifth foot tapers to an awl-like point; the outer margin near the base carries a small spine, and there is a heavy toothed bristle on the inner margin of the joint. There is a row of seven or eight spines on the distal margin of the second joint.

Length: 1.6 mm. (cephalothorax 1.2 mm.).

Coloration: Semi-transparent and without pigment.

Occurrence: Haul 2002.

Scolecithrix longirostris n. sp.

Pl. 10, figs. 12, 19; pl. 12, fig. 51

Adult female. The head is smoothly rounded, with a very long, heavy rostrum (pl. 12, fig. 19). The sides of the last thoracic segment are broadly rounded, as shown in plate 10, figure 12, which also serves to indicate the proportional lengths of the abdominal segments. The head is fused with the thorax and there is no line between the fourth and fifth segments of the thorax.

The anterior antennae are 23-jointed and 1.8 mm. long. The other appendages of the head do not present noticeable features; the maxillipeds are broken. The outer ramus of the first foot (pl. 12, fig. 51) is distinctive; there is no trace of a fifth foot.

Length: 2.07 mm. (cephalothorax 1.6 mm.).

Coloration: Without pigment and somewhat translucent.

Occurrence: Haul 2134.

Scolecithrix mollis n. sp.

Pl. 10, figs. 14, 29; pl. 12, figs. 62, 65

Adult female. The head is rounded; the rostrum is bifid, with soft and rather delicate filaments of a characteristic shape (pl. 10, fig. 29). The last thoracic segment has rounded lateral margins, the dorsal portion of the outline being indented, as shown in plate 10, figure 14. The genital segment of the abdomen is about as long as the second and third together, and four times as long as the fourth (pl. 10, fig. 14).

The outer ramus of the first foot exhibits specific characters (pl. 12, fig. 65). The fifth foot (pl. 12, fig. 62) is 2-jointed; the second joint has a short, heavy spine on the distal end, a very heavy dentate bristle at the middle of the inner margin, and two tiny spines, one at the end of the joint, the other at the middle of the outer margin.

Length: 1.55 mm. (cephalothorax about 1 mm.).

Coloration: Unpigmented and opaque in formalin.

Occurrence: Haul 2567.

Augaptilus californicus n. sp.

Pl. 10, figs. 4, 22; pl. 11, figs. 31, 40; pl. 12, figs. 43, 48

Adult female. The body is somewhat flattened. The head is rounded and carries the stiff, bifid rostrum on a projecting, fleshy eminence (pl. 10, fig. 22). The last segment of the thorax is rounded laterally and the cephalothorax is four and one-half times as long as the abdomen. The genital segment protrudes a good deal on the ventral surface and the aperture is surrounded by hairs; the segment is as long as the other two together and more than three times as long as the second segment (pl. 10, fig. 4).

The anterior antennae are 24-jointed, and are 7.3 mm. long. The inner ramus of the posterior antennae (pl. 11, fig. 40) is less than twice the length of the outer. The blade of the mandible is elongated; the arrangement of teeth on it is shown in plate 11, figure 31. The maxillipeds have distinctly cupped bristles.

The feet do not show characters that are easily described, but the outer ramus of the first foot, and the fifth foot, are

figured in plate 12, figures 43 and 48 respectively; these appendages have readily recognizable specific structures so far as the members of the genus in this region are concerned.

Length: 5.8 mm. (cephalothorax 5 mm.).

Coloration: Very transparent; there is a brown band around the twentieth joint of the anterior antennae.

Occurrence: Haul 2081.

Augaptilus depressus n. sp.

Pl. 10, figs. 11, 20, 26; pl. 11, figs. 33, 38, 42; pl. 12, figs. 44, 54

Adult female. The body is greatly flattened, with rounded head and posterior margins of the thorax; the rostral filaments are unusually long and delicate, and recurved (pl. 10, fig. 11). The cephalothorax is four and one-third times as long as the abdomen, including the furca, and nearly four times as long as the greatest breadth; the greatest width in the median sagittal plane is half that in the frontal plane. In the abdomen (pl. 10, fig. 20) the genital segment is longer than the other two segments with the furca; the genital segment is also about five times as long as the second segment and the latter is somewhat shorter than the third.

The anterior antennae are not quite so long as the cephalothorax. The inner ramus of the posterior antennae is about twice as long as the outer and extends back half way to the posterior edge of the cephalothorax; the larger plumose bristles are iridescent. The blade of the mandible is shown in plate 11, figure 33; figures 38 and 42 are outlines of the anterior and posterior antennae respectively, without the bristles. The bristles of the maxillipeds are provided with the "buttons" which are exceedingly minute; only about the distal eighth of any bristle is so equipped; the remainder of the bristles is spinose.

The outer ramus of the first foot is shown in plate 12, figure 44, and the fifth foot in figure 54; both have specific characters.

Length: 5.3 mm. (cephalothorax 4.3 mm.).

Coloration: Transparent, except for the digestive tract filled with light yellowish material; the plumose bristles of the antennae and furca are iridescent.

Occurrence: Haul 2068.

Augaptilus romanus n. sp.

Pl. 10, figs. 7, 24; pl. 11, figs. 30, 32; pl. 12, figs. 45, 47, 52

Adult male. The body is much depressed, and the head and posterior margins of the last thoracic segment are rounded. The rostral filaments are slender and delicate and borne on a prominent beak-like eminence which is set in an indentation in the front of the head (pl. 10, fig. 24). The cephalothorax is about four times as long as the abdomen and furca.

The last segment is the longest of the abdomen and the genital segment is next, then the second, third, and fourth in order (pl. 10, fig. 7).

The non-grasping antenna is 25 jointed and 5.4 mm. long; the portion of the grasping antenna proximal to the geniculation is 17-jointed (the rest was broken off). The inner ramus of the posterior antenna is twice the length of the outer ramus (pl. 11, fig. 30). The blade of the mandible is shown in plate 11, figure 32. The bristles of the maxillipeds have the buttons, and the posterior maxilliped is extremely long and slender. The outer ramus of the first foot (pl. 12, fig. 45) has distinctive characters; the fifth feet, also (pl. 12, figs. 47, 52) are easily recognizable from the figures.

Length: 4.5 mm.

Coloration: Transparent and unpigmented.

Occurrence: Haul 2081.

While this specimen was taken in the same haul with *A. californicus,* there is no other reason, so far as I can see, for considering the two as male and female of the same species.

Augaptilus simplex n. sp.

Pl. 10, figs. 10, 28; pl. 11, figs. 34, 36, 41; pl. 12, figs. 50, 60

Adult female. The head is regularly and broadly rounded; there are no rostral filaments, but the rostrum appears to be represented by a nodular protuberance, the lower one of the two shown in plate 10, figure 28. The last thoracic segment is rounded at the sides; the cephalothorax is about four and one-

half times as long as the abdomen and furca. The genital segment is markedly protuberant on the ventral border; this segment is as long as the rest of the abdomen and the furca (pl. 10, fig. 10).

The anterior antennae are 24-jointed and slightly longer than the cephalothorax. The inner ramus of the posterior antennae is between two and three times as long as the outer. The mandibular blade is shown in plate 11, figure 34, and the anterior and posterior maxillipeds in figures 41 and 36 respectively. The bristles of the maxillipeds do not have the cups or "buttons" so generally found in this genus. The feet do not appear to be unusual. Figures 50 and 60 of plate 3 show the outer ramus of the first foot and the fifth foot respectively.

Length: 6.1 mm. (cephalothorax 5 mm.).

Coloration: Transparent, but the plumose bristles of the posterior antennae and the mandible and those of the furca are iridescent.

Occurrence: Hauls 1524 and 2569.

This species appears to resemble *A. nodifrons* (Sars, 1905, p. 13), which is also arostrate and without the buttons on the bristles of the maxillipeds.

Arietellus pacificus n. sp.

Pl. 10, figs. 9, 23; pl. 12, figs. 46, 55

Adult female. The head is smoothly rounded, with an inconspicuous crest. The rostral filaments are delicate but straight and rather stiff (pl. 10, fig. 9). The sides of the last thoracic segment are rounded, as shown in plate 10, figure 23; this figure also shows the proportionate lengths of the abdominal segments and furca.

The anterior antennae are 19-jointed, and as carried on the body reach to the posterior border of the second thoracic segment. The first joint of the antenna is as long as the next eight together. The outer ramus of the first foot (pl. 12, fig. 46) shows distinctive characters. The fifth foot (pl. 12, fig. 55) is also of use in the recognition of the species.

Length: 4.5 mm. (cephalothorax 3.6 mm.).
Coloration: Opaque and without pigment.
Occurrence: Haul 1524.

Occidental College, Los Angeles, California.

Transmitted September 11, 1913.

BIBLIOGRAPHY

Esterly, C. O.
1911. Third report on the Copepoda of the San Diego Region. Univ. Calif. Publ. Zool., **6**, 313–352, pls. 26–32.

Farran, G. P.
1906. Second report on the Copepoda of the Irish Atlantic Slope. Dept. of Agr. and Tech. Instr. for Ireland, Fisheries Branch, Sci. Invest., **1906**, 3–104, pls. 1–11.

Sars, G. O.
1905. Liste préliminaire des Calanoidés recueillis pendant les Campagnes de S. A. S. le Prince Albert de Monaco. 2me Partie.

EXPLANATION OF PLATES

PLATE 10

Fig. 1. *Gaetanus ascendens* n. sp. Female, abdomen and part of last thoracic segment, from side. × 35.

Fig. 2. *Scolecithrix aculeata* n. sp. Female, abdomen and part of thorax, from side. × 70.

Fig. 3. *Gaetanus ascendens* n. sp. Female, abdomen and part of last thoracic segment, from above. × 35.

Fig. 4. *Augaptilus californicus* n. sp. Female, abdomen, from side. × 35.

Fig. 5. *Euchaeta elongata* n. sp. Female, genital segment and tip of last thoracic segment, from below. × 35.

Fig. 6. *Gaetanus ascendens* n. sp. Female, anterior part of head, from side. × 35.

Fig. 7. *Augaptilus romanus* n. sp. Male, abdomen, from above. × 35.

Fig. 8. *Scolecithrix elephas* n. sp. Female, anterior part of head, from side. × 35.

Fig. 9. *Arietellus pacificus* n. sp. Female, anterior part of head, from side. × 70.

Fig. 10. *Augaptilus simplex* n. sp. Female, abdomen, from below. × 22.

Fig. 11. *Augaptilus depressus* n. sp. Female, forehead, from side. × 35.

Fig. 12. *Scolecithrix longirostris* n. sp. Female, abdomen and last segment of thorax, from side. × 35.

Fig. 13. *Onchocalanus latus* Esterly. Female, abdomen and part of thorax, from side. × 35.

Fig. 14. *Scolecithrix mollis* n. sp. Female, abdomen and last segment of thorax, from side. × 35.

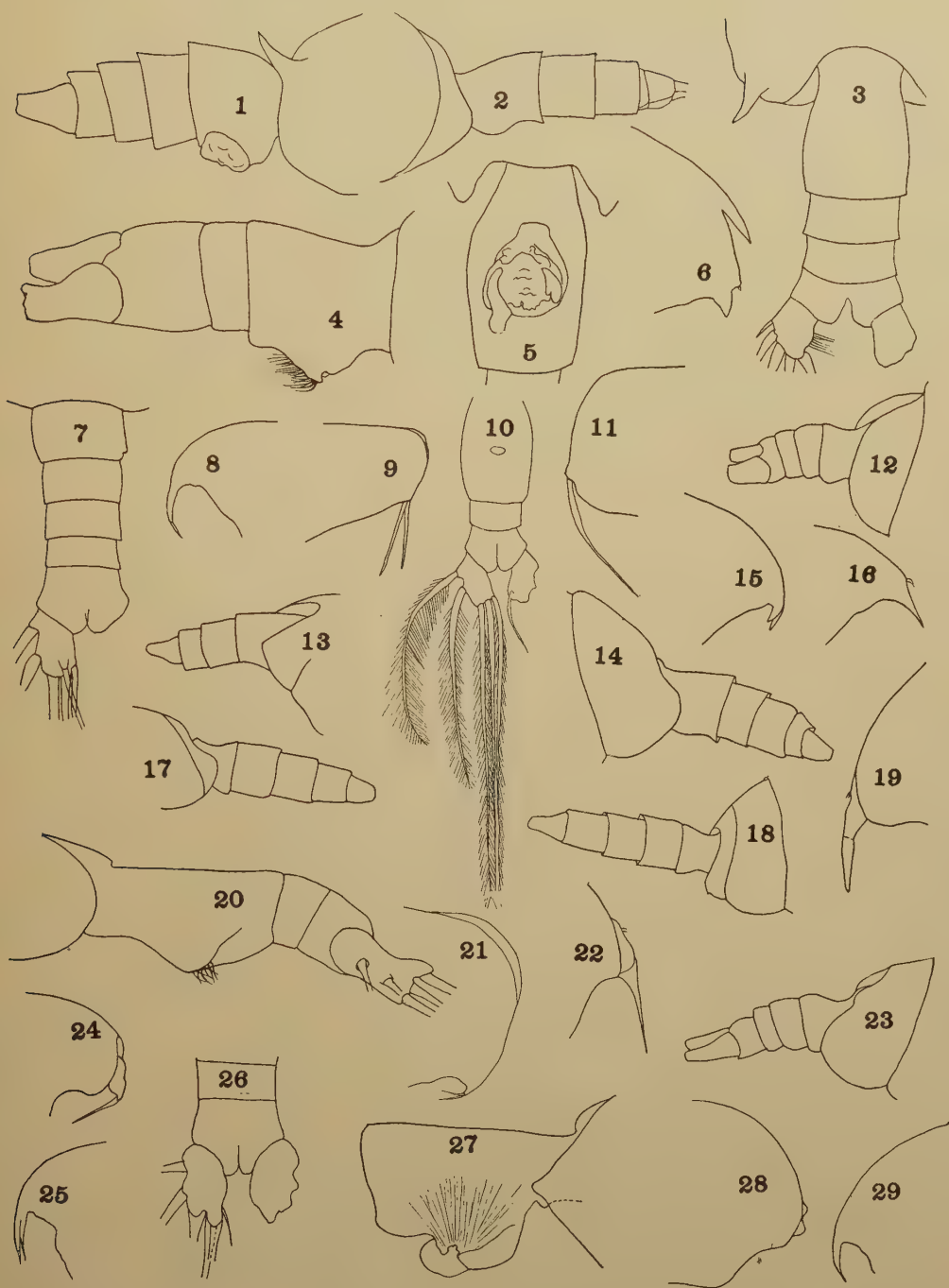
Fig. 15. *Onchocalanus latus* Esterly. Female, forehead, from side. × 35.

Fig. 16. *Euchaeta elongata* n. sp. Female, forehead, from side. × 35.

Fig. 17. *Scolecithrix elephas* n. sp. Female and posterior part of thorax, from side. × 35.

Fig. 18. *Scolecithrix obscura* n. sp. Female, abdomen and last two thoracic segments, from side. × 35.

Fig. 19. *Scolecithrix longirostris* n. sp. Female, forehead, from side. × 70.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EXPLANATION OF PLATE 10—*Continued*

Fig. 20. *Augaptilus depressus* n. sp. Female, abdomen, from side. × 35.

Fig. 21. *Scolecithrix obscura* n. sp. Female, forehead, from side. × 70.

Fig. 22. *Augaptilus californicus* n. sp. Female, forehead, from side. × 35.

Fig. 23. *Arietellus pacificus* n. sp. Female, abdomen and last segment of thorax, from side. × 35.

Fig. 24. *Augaptilus romanus* n. sp. Female, forehead, from side. × 35.

Fig. 25. *Scolecithrix aculeata* n. sp. Female, forehead, from side. × 35.

Fig. 26. *Augaptilus depressus* n. sp. Female, second and third segments of abdomen, and furca, from above. × 35.

Fig. 27. *Euchaeta elongata* n. sp. Female, genital segment and tip of thorax, from side. × 35.

Fig. 28. *Augaptilus simplex* n. sp. Female, forehead, from side. × 22.

Fig. 29. *Scolecithrix mollis* n. sp. Female, forehead, from side. × 35.

PLATE 11

Fig. 30. *Augaptilus romanus* n. sp. Male, posterior antenna. × 47.

Fig. 31. *Augaptilus californicus* n. sp. Female, mandibular blade. × 93.

Fig. 32. *Augaptilus romanus* n. sp. Male, mandibular blade. × 145.

Fig. 33. *Augaptilus depressus* n. sp. Female, mandibular blade. × 145.

Fig. 34. *Augaptilus simplex* n. sp. Female, mandibular blade. × 93.

Fig. 35. *Scolecithrix obscura* n. sp. Female, sensory appendages of anterior maxilliped. × 145.

Fig. 36. *Augaptilus simplex* n. sp. Female, posterior maxilliped. × 30.

Fig. 37. *Euchaeta elongata* n. sp. Female, second and third joints of outer ramus of second foot. × 47.

Fig. 38. *Augaptilus depressus* n. sp. Female, outline of anterior maxilliped without the bristles. × 47.

Fig. 39. *Gaetanus ascendens* n. sp. Female, first basal of posterior maxilliped. × 93.

Fig. 40. *Augaptilus californicus* n. sp. Female, posterior antenna. × 47.

Fig. 41. *Augaptilus simplex* n. sp. Female, anterior maxilliped. × 47.

Fig. 42. *Augaptilus depressus* n. sp. Female, outline of posterior maxilliped without the bristles. × 47.

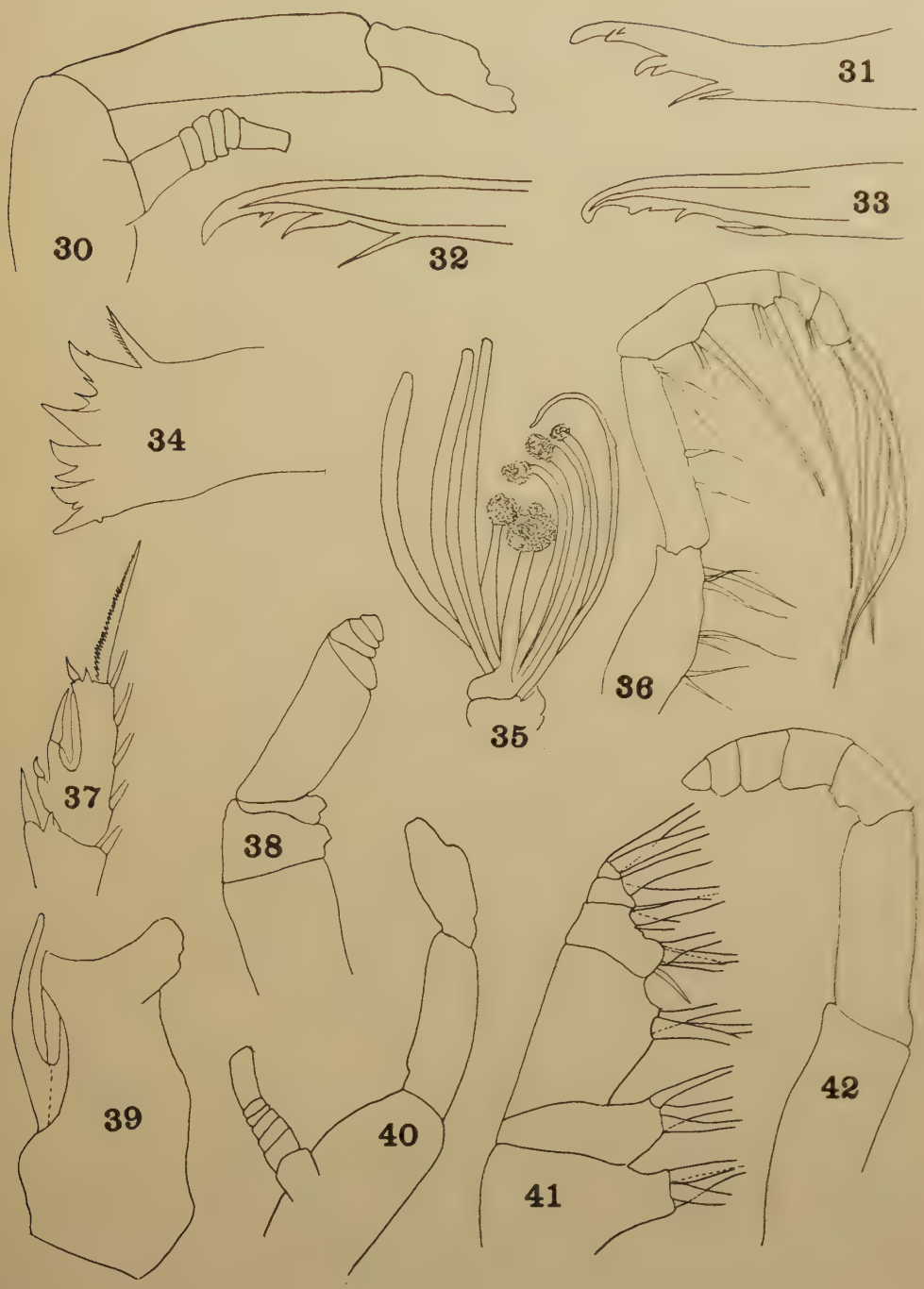
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PLATE 12

Fig. 43. *Augaptilus californicus* n. sp. Female, outer ramus of first foot. × 70.

Fig. 44. *Augaptilus depressus* n. sp. Female, outer ramus of first foot. × 70.

Fig. 45. *Augaptilus romanus* n. sp. Male, outer ramus of first foot. × 70.

Fig. 46. *Arietellus pacificus* n. sp. Female, first foot. × 35.

Fig. 47. *Augaptilus romanus* n. sp. Male, right fifth foot. × 70.

Fig. 48. *Augaptilus californicus* n. sp. Female, fifth foot. × 35.

Fig. 49. *Euchaeta elongata* n. sp. Female, outer ramus of first foot. × 70.

Fig. 50. *Augaptilus simplex* n. sp. Female, outer ramus of first foot. × 35.

Fig. 51. *Scolecithrix longirostris* n. sp. Female, first foot without inner ramus. × 70.

Fig. 52. *Augaptilus romanus* n. sp. Male, left fifth foot. × 70.

Fig. 53. *Scolecithrix obscura* n. sp. Female, outer ramus of first foot. × 70.

Fig. 54. *Augaptilus depressus* n. sp. Female, fifth foot. × 70.

Fig. 55. *Arietellus pacificus* n. sp. Female, fifth foot. × 70.

Fig. 56. *Gaetanus ascendens* n. sp. Female, outer ramus of first foot. × 70.

Fig. 57. *Scolecithrix obscura* n. sp. Female, fifth foot. × 188.

Fig. 58. *Onchocalanus latus* Esterly. Female, outer ramus of first foot. × 70.

Fig. 59. *Scolecithrix elephas* n. sp. Female, outer ramus of first foot. × 90.

Fig. 60. *Augaptilus simplex* n. sp. Female, fifth foot. × 35.

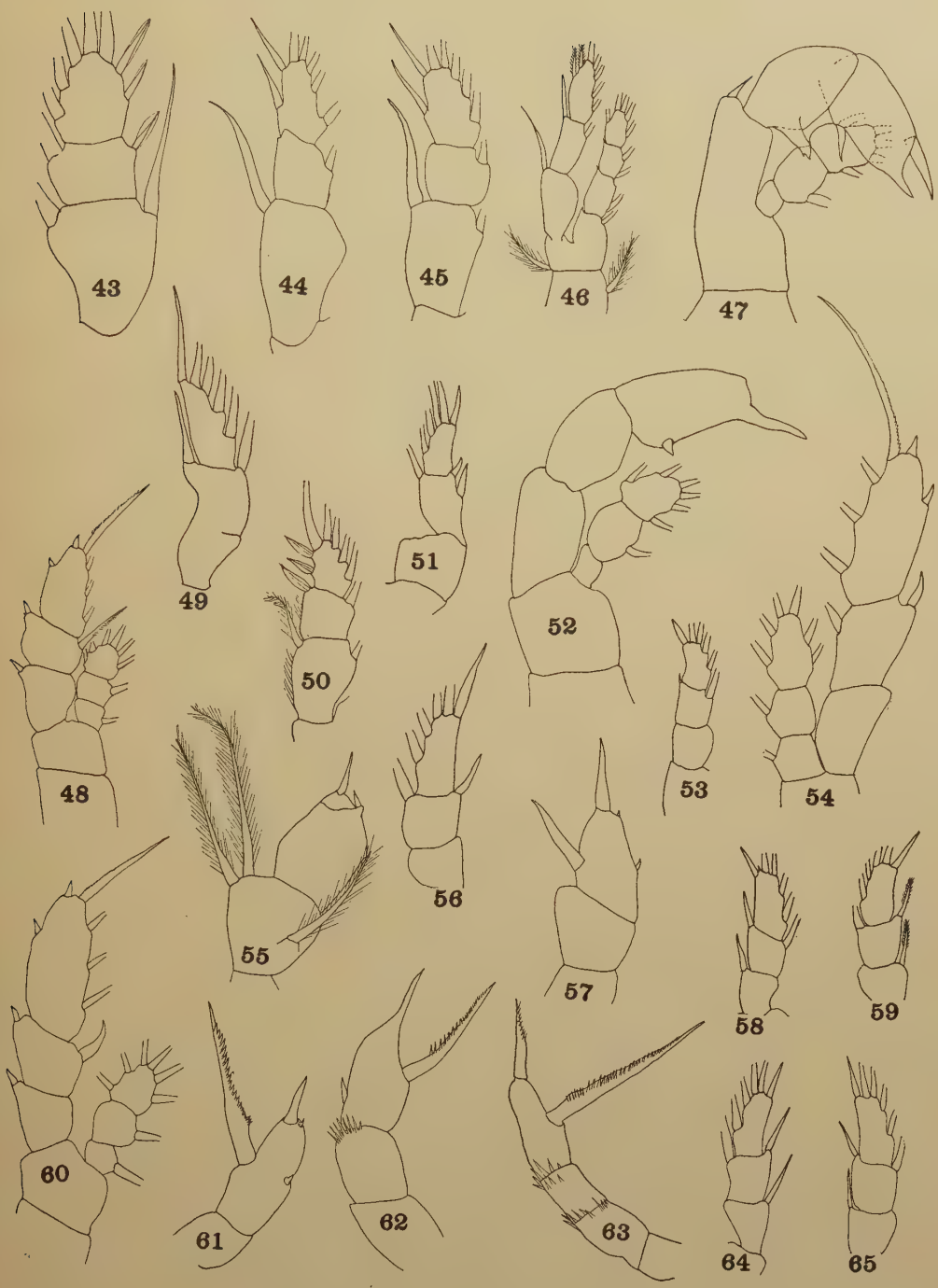
Fig. 61. *Scolecithrix aculeata* n. sp. Female, fifth foot. × 188.

Fig. 62. *Scolecithrix elephas* n. sp. Female, fifth foot. × 250.

Fig. 63. *Scolecithrix aculeata* n. sp. Female, fifth foot. × 188.

Fig. 64. *Scolecithrix aculeata* n. sp. Female, outer ramus of first foot. × 70.

Fig. 65. *Scolecithrix mollis* n. sp. Female, outer ramus of first foot. × 93.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